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PATENT ABSTRACTS OF JAPAN

(11)Publication number : 07-088116
(43)Date of publication of application : 04.04.1995

(51)Int.Cl. A61B 17/36
A61N 5/06
G02B 6/10

(21)Application number : 05-239786
(22)Date of filing : 27.09.1993

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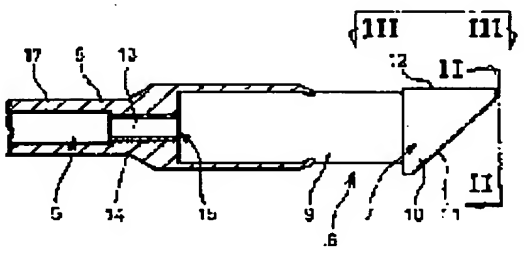
(54) LASER SIDE ILLUMINATOR

(57)Abstract:
PURPOSE: To efficiently and effectively make the illuminator useful for a medical treatment and a diagnosis by constituting it so that a laser beam having a satisfactory beam profile can be subjected to spot irradiation to a lesion generated in a specific part on an inner wall of the sophagus and the bronchus.
CONSTITUTION: This illuminator is provided with an optical fiber 5 for guiding a laser beam, and a microchip 6 having in the tip part a 90° prism-like structure part 7 for allowing the laser beam guided from the optical fiber 5 to be subjected to full reflection to the side. Also, a core 13 of the optical fiber 5 and the microchip 6 are both made of quartz, and moreover, a joined part 15 of the core 13 of the optical fiber 5 and the microchip 6 becomes an optical contact.



LEGAL STATUS

[Date of request for examination] 06.10.1999
[Date of sending the examiner's decision of rejection] 13.08.2002
[Kind of final disposal of application other than the xaminer's decision of rejection or application converted r gistration]
[Dat f final disposal for application]
[Patent number]
[Date of registration]
[Number of appeal against examin r's decision f r j ction]
[Date of r questing app al against examin r's decision of r j ction]
[Date f extinction f right]

* NOTICES *

1.This document has b en translated by computer. So the translation may not reflect the original precis ly.
2.**** shows the word which can not be translat d.
3.In the drawings, any w rds are not translated.

CLAIMS

[Claim(s)]
[Claim 1] the prism for making the side carry out total reflection of the optical fiber which carries out the light guid of the laser beam, and the laser beam by which the light guide was carried out from this optical fiber — the laser characterized by having the microchip which has the structured division [like] in a point — the side — an irradiation machine
[Claim 2] the prism in a microchip — the laser according to claim 1 in which the concave surface section for making the outgoing radiation end face [like] of the structured division diffuse a laser beam uniformly was formed — the side — an irradiation machine
[Claim 3] the laser according to claim 1 or 2 which made both the cores and microchips of an optical fiber the product made from a quartz, and made the optical contact the core of the aforementioned optical fiber, and the joint of a microchip — the side — an irradiation machine

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[Translation done.]

DETAILED DESCRIPTION

[Detail d Description of the Invention]
[0001]
[Industrial Application] this invention — laser — the side — it is related with an irradiation machine
[0002]
[Description of the Prior Art] In recent years, the so-called development of the photochemistry treatment (PDT:Photodynamic Therapy or PDD:Photodynamic Diagnosis) which irradiates a laser beam and performs treatment and a diagnosis is furthered also to the affected parts, such as cancer produced in walls, such as an esophagus and a bronchial tube.
[0003] the laser used for this kind of photochemistry treatment — the side — as an irradiation machine, there are some which were indicated by the former, for example, JP,3-20303,U, and as shown in drawing 7 , this establishes the cone crevic 2 for laser reflection in the front face of the terminal 1 of the laser end of the probe, makes an incident light 3 refl ct in the aforementioned cone crevice 2, and irradiates the reflected light 4 to the affected part
[0004]
[Probl m(s) to be Solved by the Invention] however, the laser like the above-mentioned — the side — since outgoing radiation of the laser beam is carried out from [of the terminal 1 side] a perimeter as the reflected light 4, although the affected part exists in the specific part of walls, such as an esophagus and a bronchial tube, like an esophagus canc r or a cancer of bronchus with an irradiation vessel — a case — except for the affected part — the laser beam was irradiated by the normal cell section and an injury may have been done to this normal cell section
[0005] Moreover, if outgoing radiation of the laser beam was carried out from [of the terminal 1 side] a perimeter as the reflected light 4, since the laser intensity of the irradiation section would fall, it had the fault that on the other hand tim could not obtain a uniform beam profile for treatment on this structure of reflecting a laser beam in the direction of a p rimeter in the cone crevice 2.
[0006] the laser which this invention can carry out spot irradiation of the laser beam which has a good beam profile to the aff cted part produced to the specific part of walls, such as an esophagus and a bronchial tube, in view of this actual condition, and is useful to efficient and effective treatment and a diagnosis — the side — it is going to offer an irradiation machine
[0007]
[Means for Solving the Problem] the laser characterized by equipping this invention with the optical fiber which carries out the light guide of the laser beam, and the microchip which has in a point the prism Mr. structured division for making the side carry out total reflection of the laser beam by which the light guide was carried out from this optical fiber — the side — an irradiation machine is started
[0008] Moreover, it is effective to form the concave surface section for making the outgoing radiation end face of the prism Mr. structured division in the aforementioned microchip diffuse a laser beam uniformly.
[0009] Furthermore, it is also effective to make both the cores and microchips of the aforementioned optical fiber into the product made from a quartz, and to make the core of the aforementioned optical fiber and the joint of a microchip into an optical contact again.
[0010]
[Function] Insert the optical fiber which attached the microchip at the nose of cam into the pipe of the endoscope inserted in the esophagus, the bronchial tube, etc., and the outgoing radiation end face of the prism Mr. structured division in the aforementioned microchip in the state where face to face was made to stand against the affected part If a laser beam is irradiated, incidence of this laser beam will be carried out to a microchip through a joint from an optical fiber. Spread the inside of this microchip, total reflection is carried out by the prism Mr. structured division, and this laser beam by which total reflection was carried out Even if it is a case although the affected part exists in the specific part of walls, such as an esophagus and a bronchial tube, like an esophagus cancer or a cancer of bronchus since spot irradiation is carried out from an outgoing radiation end face to the aforementioned affected part Since the laser beam by which a laser beam was not irradiated by the normal cell sections other than the affected part, doing an injury to this normal cell section was lost, and outgoing radiation was carried out can be held with a beam state Since the laser intensity of the irradiation section does not fall and a good beam profile can be maintained, efficient treatment will be comparatively performed by short-time irradiation.
[0011] Moreover, if the concave surface section for making the outgoing radiation end face of the prism Mr. structur d division in a microchip diffuse a laser beam uniformly is formed, since a bigger beam dilation ratio will be obtained, correspondence also in the irradiation to the larger affected part is attained.
[0012] Furthermore, both the cores and microchips of an optical fiber are made into the product made from a quartz, and th reflection loss of an optical contact, then the laser beam in a joint decreases the core of the aforementioned optical fib r, and the joint of a microchip very much again.
[0013]
[Exampl] Her after, th example of this inventi n is xplain d, referring to a drawing.
[0014] Drawing 1 -3 are one xample of this invention, and th microchip which has in a point the 90-degr e prism Mr. structur d division 7 for the ptical fiber t which 5 carri s ut the light guide of the laser b am, and 6 making th sid carry out t tal r flection of the las r b am by which th light guide was carried out from the ptical fiber 5, and 8 ar sleev s which carry out junction fixation of an ptical fib r 5 and the microchip 6.
[0015] The 90-degree prism Mr. structured division 7 in the afor m ntioned microchip 6 While f rming th pillar-lik section 10 of a major diamet r in ne m r slightly than this microchip base 9, cutting th apical surface sid of this

pillar-lik s ction 10 at the n se of cam of the microchip base 9 which has a circular cross section at the angle of 45 degrees and forming the total reflection sid 11 in it By forming in th peripheral face n cessary position of the aforementioned pillar-lik section 10 th outgoing radiation end face 12 which mak s this total reflection sid 11 and the angl of 45 degrees, and confronts each other, and making a peripheral face circular, a corner is lost as much as possibl and it has passed along the inside of th pipe of an endoscope (not shown) smoothly.
[0016] Moreov r, both th cores 13 and microchips 6 of the aforementioned optical fiber 5 are mad into the product made from a quartz, and th joint 15 of core 13 apical surface of th aforementioned optical fiber 5 and a six microchip nd face is made into th optical contact (optical junction).
[0017] in addition, the thing for which fixation with the afor mentioned optical fiber 5 and a sle ve 8 pastes up the clad 14 of an optical fiber 5, and covering 17 and sleeve 8 inside — carrying out — moreover, fixation with a sleeve 8 and a microchip 6 — the point of a sleeve 8 — microchip base 9 peripheral face of a microchip 6 — receiving — it has been mad to carry out by closing
[0018] Next, the operation of the above-mentioned example is explained.
[0019] The optical fiber 5 which attached the microchip 6 at the nose of cam is inserted into the pipe of the endoscope ins rted in the esophagus, the bronchial tube, etc. which is not illustrated. Where the outgoing radiation end face 12 of the 90-degree prism Mr. structured division 7 in the aforementioned microchip 6 is confronted with the affected part, when a laser beam is irradiated, this laser beam Carry out incidence to a microchip 6 through a joint 15 from an optical fiber 5, and the inside of a microchip 6 is spread with the flare angle decided by NA (Numerical Aperture) of an optical fiber 5, and the refractive index n of a microchip 6. Total reflection is carried out in respect of [11] the total reflection of the 90-degree prism Mr. structured division 7, and spot irradiation of this laser beam by which total reflection was carri d out is carried out from the outgoing radiation end face 12 to the aforementioned affected part.
[0020] Consequently, although the affected part exists in the specific part of walls, such as an esophagus and a bronchial tube, like an esophagus cancer or bronchial tube cancer, even if it is a case, a laser beam is not irradiated by the normal cell sections other than the affected part, but doing damage to this normal cell section is lost.
[0021] Moreover, since the laser intensity of the irradiation section does not fall since the laser beam by which outgoing radiation was carried out can be held with a beam state, and the comparatively good beam profile of the Gaussian distribution or the semi- flat top can be maintained, efficient medical treatment will be comparatively performed by short-time irradiation.
[0022] Furthermore, the reflection loss of the laser beam in a joint 15 decreases very much by having made both the cores 13 and microchips 6 of an optical fiber 5 into the product made from a quartz, and having made the joint 15 of the core 13 of the aforementioned optical fiber 5, and a microchip 6 into the optical contact again.
[0023] In this way, spot irradiation of the laser beam which has a good beam profile to the affected part produced to the specific part of walls, such as an esophagus and a bronchial tube, can be carried out, and it becomes possible to use for efficient and effective medical treatment and a diagnosis.
[0024] Although drawing 4 -6 are other examples of this invention, the portion which attached the same sign as drawing 1 -3 expresses the same object among drawing and fundamental composition is the same as that of what is shown in drawing 1 -3 The place by which it is characterized [of this example] is in the point in which the concave surface section 16 for making the outgoing radiation end face 12 of the 90-degree prism Mr. structured division 7 in a microchip 6 diffuse a laser beam uniformly was formed, as shown in drawing 4 -6.
[0025] In the example shown in drawing 4 -6, when the affected part in an esophagus, a bronchial tube, etc. is comparatively large The optical fiber 5 which attached the microchip 6 at the nose of cam is inserted into the pipe of th endoscope inserted in the esophagus, the bronchial tube, etc. which is not illustrated. Where the concave surface section 16 of the outgoing radiation end face 12 of the 90-degree prism Mr. structured division 7 in the aforementioned microchip 6 is confronted with the aforementioned affected part, when a laser beam is irradiated, this laser beam Carry out incidence to a microchip 6 through a joint 15 from an optical fiber 5, and the inside of a microchip 6 is spread with the flare angle decided by NA of an optical fiber 5, and the refractive index n of a microchip 6. Total reflection is carried out in respect of [11] the total reflection of the 90-degree prism Mr. structured division 7, and spot irradiation of this laser beam by which total reflection was carried out is carried out from the concave surface section 16 of the outgoing radiation end face 12 with a comparatively big beam dilation ratio to the aforementioned affected part.
[0026] Therefore, spot irradiation of the laser beam which has a good beam profile also to the comparatively larger affect d part produced to the specific part of walls, such as an esophagus and a bronchial tube, in the case of the xample shown in drawing 4 -6 can be carried out, and it becomes possible to use for efficient and effective treatment and a diagnosis.
[0027] in addition, the laser of this invention — the side — the irradiation machine of the ability of change to be variously added within limits which are not limited only to an above-mentioned example and do not deviate from the summary of this invention is natural
[0028]
[Effect of the Invention] According to the irradiation machine, spot irradiation of the laser beam which has a good beam profil to the affected part produced to the specific part of walls, such as an esophagus and a bronchial tube, can be carried out. in the above, it explained — as — the laser of this invention — the side — If the concave surface section for being able to do so the outstanding effect that it can use for efficient and effective medical treatment and a diagnosis, and making the outgoing radiation end face of the prism Mr. structured division in a microchip diffuse a laser beam uniformly is formed A bigger beam dilation ratio can be obtained and it can respond also to the irradiation to the larger affected part. Furthermore, the effect which was excellent in various [of both the cores and microchips of an optical fiber being made into the product made from a quartz, and being able to lessen the reflection loss of an optical contact, then the laser beam in a joint for the core of the aforementioned optical fiber and the joint of a microchip very much again] can be done so.

[Translation don .]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the important section expanded sectional view of one example of this invention.
[Drawing 2] It is the II-II view view of drawing 1 .
[Drawing 3] It is the III-III view view of drawing 1 .
[Drawing 4] It is the important section expanded sectional view of other examples of this invention.
[Drawing 5] It is the V-V view view of drawing 4 .
[Drawing 6] It is the VI-VI view view of drawing 4 .
[Drawing 7] It is the important section expanded sectional view of the conventional example.
[Description of Notations]
5 Optical Fiber
6 Microchip
7 90 Degree Prism Mr. Structured Division (Prism Structured Division [like])
11 Total Reflection Side
12 Outgoing Radiation End Face
13 Core of Optical Fiber
15 Joint
16 Concave Surface Section

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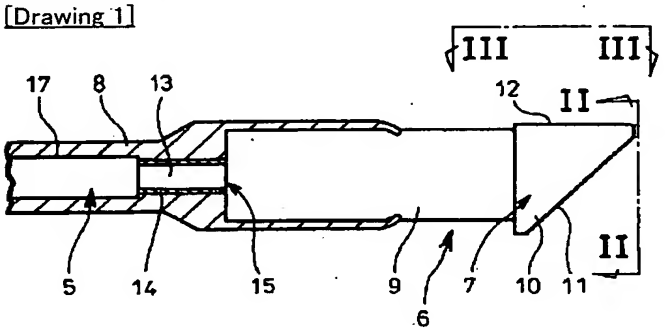
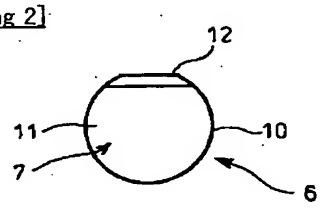
* NOTICES *

DRAWINGS

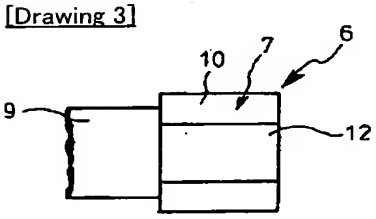
[Drawing 1]



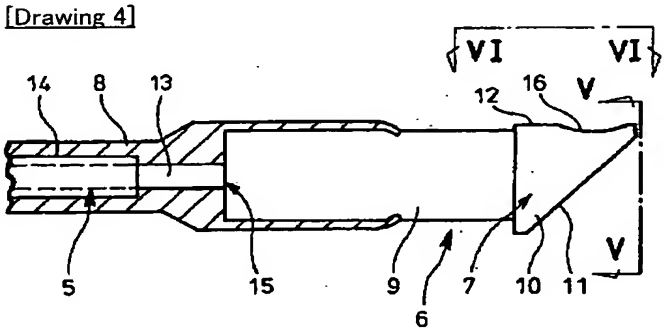
[Drawing 2]



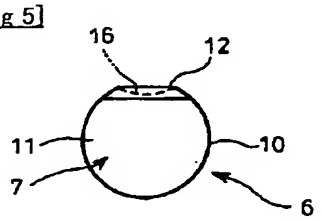
[Drawing 3]



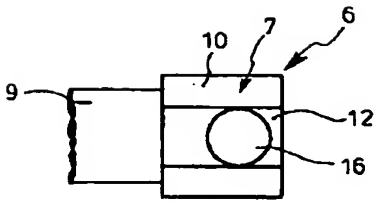
[Drawing 4]



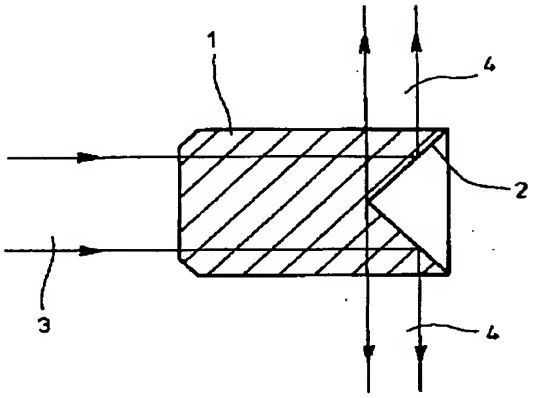
[Drawing 5]



[Drawing 6]



[Drawing 7]



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(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号

特開平7－88116

(43)公開日　平成７年(1995)４月４日

(51)Int.Cl.[6]		識別記号	庁内整理番号	ＦＩ	技術表示箇所
Ａ６１Ｂ	17/36	３５０			
Ａ６１Ｎ	5/06		Ｅ		
Ｇ０２Ｂ	6/10		Ｄ	7036－2Ｋ	

審査請求　未請求　請求項の数３　ＯＬ　（全５頁）

(21)出願番号　特願平5－239786

(22)出願日　平成５年(1993)９月27日

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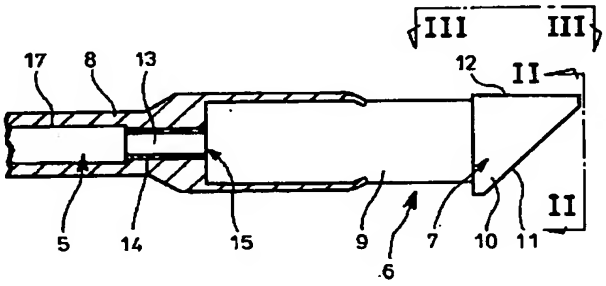
最終頁に続く

(54)【発明の名称】　レーザ側方照射器

(57)【要約】

【目的】　食道や気管支等の内壁の特定部位に生じた患部に対して良好なビームプロファイルを有するレーザ光をスポット照射し得、効率的、効果的な治療や診断に役立つレーザ側方照射器を提供する。

【構成】　レーザ光を導光する光ファイバ５と、該光ファイバ５から導光されたレーザ光を側方に全反射させるための９０°プリズム様構造部７を先端部に有するマイクロチップ６とを備え、光ファイバ５のコア１３とマイクロチップ６を共に石英製とし、且つ前記光ファイバ５のコア１３とマイクロチップ６の接合部１５をオプティカルコンタクトとする。



【特許請求の範囲】
【請求項１】　レーザ光を導光する光ファイバと、該光ファイバから導光されたレーザ光を側方に全反射させるためのプリズム様の構造部を先端部に有するマイクロチップとを備えたことを特徴とするレーザ側方照射器。
【請求項２】　マイクロチップにおけるプリズム様の構造部の出射端面に、レーザ光を均一に拡散させるための凹面部を形成した請求項１記載のレーザ側方照射器。
【請求項３】　光ファイバのコアとマイクロチップを共に石英製とし、且つ前記光ファイバのコアとマイクロチップの接合部をオプティカルコンタクトとした請求項１又は２記載のレーザ側方照射器。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】本発明は、レーザ側方照射器に関するものである。
【０００２】
【従来の技術】近年、食道や気管支等の内壁に生じた癌等の患部に対しても、レーザ光を照射して治療や診断を行う、いわゆる光化学療法（ＰＤＴ：Ｐｈｏｔｏｄｙｎａｍｉｃ　Ｔｈｅｒａｐｙ又はＰＤＤ：Ｐｈｏｔｏｄｙｎａｍｉｃ　Ｄｉａｇｎｏｓｉｓ）の開発が進められている。
【０００３】この種の光化学療法に使用されるレーザ側方照射器としては、従来、例えば、実開平３－２０３０３号公報に記載されたものがあり、これは、図７に示される如く、レーザプローブ先端の端子１の前面にレーザ反射用の円錐形凹部２を設けたものであり、入射光３を前記円錐形凹部２で反射せしめ、反射光４を患部へ照射するようになっている。
【０００４】
【発明が解決しようとする課題】しかしながら、前述の如きレーザ側方照射器では、レーザ光が反射光４として端子１側方の全周方向から出射されるため、食道癌や気管支癌等のように患部が食道や気管支等の内壁の特定部位に存在するものの場合、患部以外の正常細胞部にもレーザ光が照射され、該正常細胞部に損傷を与えてしまう可能性があった。
【０００５】又、レーザ光が反射光４として端子１側方の全周方向から出射されると、照射部のレーザ強度が低下するため、治療に時間がかかる一方、円錐形凹部２でレーザ光を全周方向へ反射させるという構造上、均一なビームプロファイルを得ることができないという欠点を有していた。
【０００６】本発明は、斯かる実情に鑑み、食道や気管支等の内壁の特定部位に生じた患部に対して良好なビームプロファイルを有するレーザ光をスポット照射し得、効率的、効果的な治療や診断に役立つレーザ側方照射器を提供しようとするものである。
【０００７】
【課題を解決するための手段】本発明は、レーザ光を導光する光ファイバと、該光ファイバから導光されたレーザ光を側方に全反射させるためのプリズム様構造部を先端部に有するマイクロチップとを備えたことを特徴とするレーザ側方照射器にかかるものである。
【０００８】又、前記マイクロチップにおけるプリズム様構造部の出射端面に、レーザ光を均一に拡散させるための凹面部を形成することが有効である。
【０００９】更に又、前記光ファイバのコアとマイクロチップを共に石英製とし、且つ前記光ファイバのコアとマイクロチップの接合部をオプティカルコンタクトとするのも有効である。
【００１０】
【作用】先端にマイクロチップを取り付けた光ファイバを、食道や気管支等に挿入してある内視鏡の管内に挿入し、前記マイクロチップにおけるプリズム様構造部の出射端面を患部に対峙させた状態で、レーザ光を照射すると、該レーザ光は、光ファイバから接合部を経てマイクロチップに入射し、該マイクロチップ中を伝播し、プリズム様構造部で全反射され、該全反射されたレーザ光は、出射端面から前記患部に対しスポット照射されるため、食道癌や気管支癌等のように患部が食道や気管支等の内壁の特定部位に存在するものの場合であっても、患部以外の正常細胞部にレーザ光が照射されず、該正常細胞部に損傷を与えてしまうことがなくなり、又、出射されたレーザ光をビーム状態のまま保持することができるので、照射部のレーザ強度が低下することはなく、且つ良好なビームプロファイルを保てるので比較的短時間の照射で効率的な治療が行われることとなる。
【００１１】又、マイクロチップにおけるプリズム様構造部の出射端面にレーザ光を均一に拡散させるための凹面部を形成すれば、より大きなビーム拡大率が得られるため、大きめの患部への照射にも対応可能となる。
【００１２】更に又、光ファイバのコアとマイクロチップを共に石英製とし、且つ前記光ファイバのコアとマイクロチップの接合部をオプティカルコンタクトとすれば、接合部でのレーザ光の反射損失が非常に少なくなる。
【００１３】
【実施例】以下、本発明の実施例を図面を参照しつつ説明する。
【００１４】図１～３は本発明の一実施例であって、５はレーザ光を導光する光ファイバ、６は光ファイバ５から導光されたレーザ光を側方に全反射させるための９０°プリズム様構造部７を先端部に有するマイクロチップ、８は光ファイバ５とマイクロチップ６を接合固定するスリーブである。
【００１５】前記マイクロチップ６における９０°プリズム様構造部７は、円形断面を有するマイクロチップ基部９の先端に、該マイクロチップ基部９より僅かに大径

の円柱状部１０を一体に形成し、該円柱状部１０の先端面側を４５°の角度で切断して全反射面１１を形成すると共に、該全反射面１１と４５°の角度をなして対峙する出射端面１２を前記円柱状部１０の外周面所要位置に形成したものであり、外周面を円形とすることにより、角部を極力なくし、内視鏡（図示せず）の管内を滑らかに通るようにしてある。

【００１６】又、前記光ファイバ５のコア１３とマイクロチップ６は共に石英製とし、且つ前記光ファイバ５のコア１３先端面とマイクロチップ６基端面との接合部１５は、オプティカルコンタクト（光学接合）としてある。

【００１７】尚、前記光ファイバ５とスリーブ８との固定は、光ファイバ５のクラッド１４及び被覆１７とスリーブ８内面とを接着することによって行い、又、スリーブ８とマイクロチップ６との固定は、スリーブ８の先端部をマイクロチップ６のマイクロチップ基部９外周面に対してかしめることによって行うようにしてある。

【００１８】次に、上記実施例の作動を説明する。

【００１９】先端にマイクロチップ６を取り付けた光ファイバ５を、食道や気管支等に挿入してある図示していない内視鏡の管内に挿入し、前記マイクロチップ６における９０°プリズム様構造部７の出射端面１２を患部に対峙させた状態で、レーザ光を照射すると、該レーザ光は、光ファイバ５から接合部１５を経てマイクロチップ６に入射し、光ファイバ５のＮＡ（Ｎｕｍｅｒｉｃａｌ　Ａｐｅｒｔｕｒｅ）とマイクロチップ６の屈折率ｎで決まる拡がり角をもってマイクロチップ６中を伝播し、９０°プリズム様構造部７の全反射面１１で全反射され、該全反射されたレーザ光は、出射端面１２から前記患部に対しスポット照射される。

【００２０】この結果、食道癌や気管支癌等のように患部が食道や気管支等の内壁の特定部位に存在するものの場合であっても、患部以外の正常細胞部にはレーザ光が照射されず、該正常細胞部に損傷を与えてしまうことがなくなる。

【００２１】又、出射されたレーザ光をビーム状態のまま保持することができるので、照射部のレーザ強度が低下することはなく、且つガウス分布様、若しくは準フラットトップの比較的良好なビームプロファイルを保てるので比較的短時間の照射で効率的な治療が行われることとなる。

【００２２】更に又、光ファイバ５のコア１３とマイクロチップ６を共に石英製とし、且つ前記光ファイバ５のコア１３とマイクロチップ６との接合部１５をオプティカルコンタクトとしたことにより、接合部１５でのレーザ光の反射損失が非常に少なくなる。

【００２３】こうして、食道や気管支等の内壁の特定部位に生じた患部に対して良好なビームプロファイルを有するレーザ光をスポット照射することができ、効率的、効果的な治療や診断に役立てることが可能となる。

【００２４】図４～６は本発明の他の実施例であって、図中、図１～３と同一の符号を付した部分は同一物を表わしており、基本的な構成は図１～３に示すものと同様であるが、本実施例の特徴とするところは、図４～６に示す如く、マイクロチップ６における９０°プリズム様構造部７の出射端面１２にレーザ光を均一に拡散させるための凹面部１６を形成した点にある。

【００２５】図４～６に示す実施例においては、食道や気管支等における患部が比較的大きいような場合に、先端にマイクロチップ６を取り付けた光ファイバ５を、食道や気管支等に挿入してある図示していない内視鏡の管内に挿入し、前記マイクロチップ６における９０°プリズム様構造部７の出射端面１２の凹面部１６を前記の患部に対峙させた状態で、レーザ光を照射すると、該レーザ光は、光ファイバ５から接合部１５を経てマイクロチップ６に入射し、光ファイバ５のＮＡとマイクロチップ６の屈折率ｎで決まる拡がり角をもってマイクロチップ６中を伝播し、９０°プリズム様構造部７の全反射面１１で全反射され、該全反射されたレーザ光は、出射端面１２の凹面部１６から前記の患部に対し、比較的大きなビーム拡大率でスポット照射される。

【００２６】従って、図４～６に示す実施例の場合には、食道や気管支等の内壁の特定部位に生じた比較的大きめの患部に対しても良好なビームプロファイルを有するレーザ光をスポット照射することができ、効率的、効果的な治療や診断に役立てることが可能となる。

【００２７】尚、本発明のレーザ側方照射器は、上述の実施例にのみ限定されるものではなく、本発明の要旨を逸脱しない範囲内において種々変更を加え得ることは勿論である。

【００２８】

【発明の効果】以上、説明したように本発明のレーザ側方照射器によれば、食道や気管支等の内壁の特定部位に生じた患部に対して良好なビームプロファイルを有するレーザ光をスポット照射し得、効率的、効果的な治療や診断に役立てることができるという優れた効果を奏し得、又、マイクロチップにおけるプリズム様構造部の出射端面にレーザ光を均一に拡散させるための凹面部を形成すれば、より大きなビーム拡大率を得ることができ、大きめの患部への照射にも対応することができ、更に又、光ファイバのコアとマイクロチップを共に石英製とし、且つ前記光ファイバのコアとマイクロチップの接合部をオプティカルコンタクトとすれば、接合部でのレーザ光の反射損失を非常に少なくすることができる等の種々の優れた効果を奏し得る。

【図面の簡単な説明】

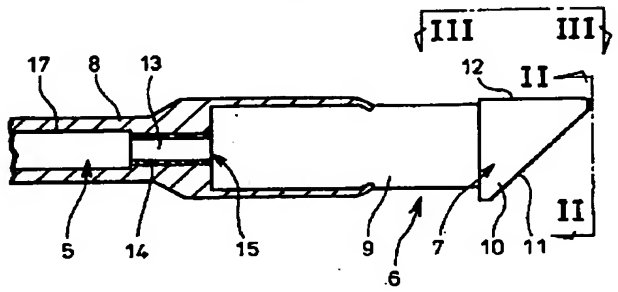
【図１】本発明の一実施例の要部拡大断面図である。

【図２】図１のＩＩ－ＩＩ矢視図である。

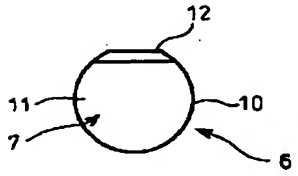
【図３】図１のＩＩＩ－ＩＩＩ矢視図である。

【図４】本発明の他の実施例の要部拡大断面図である。
【図５】図４のＶ－Ｖ矢視図である。
【図６】図４のＶＩ－ＶＩ矢視図である。
【図７】従来例の要部拡大断面図である。
【符号の説明】
５　　光ファイバ
６　　マイクロチップ
７　　９０°プリズム様構造部（プリズム様の構造部）
１１　　全反射面
１２　　出射端面
１３　　光ファイバのコア
１５　　接合部
１６　　凹面部

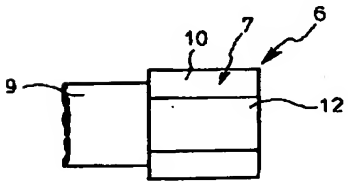
【図１】



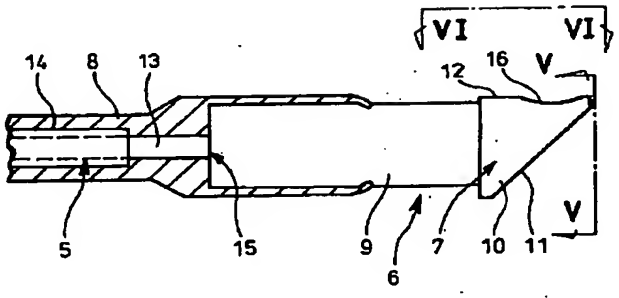
【図２】



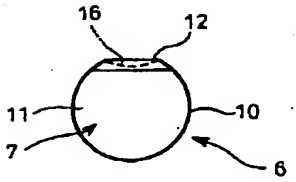
【図３】



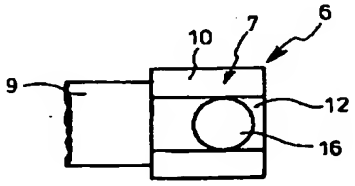
【図４】



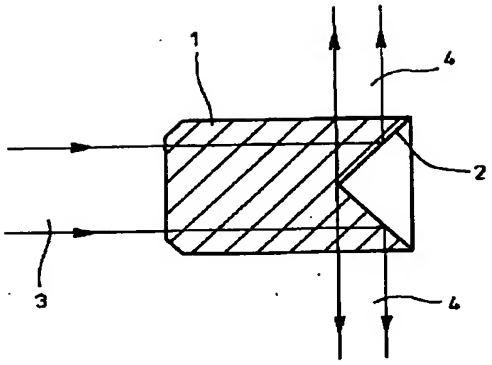
【図５】



【図６】



【図７】



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